Zurich Open Repository and Archive
University of Zurich
University Library
Strickhofstrasse 39
CH-8057 Zurich
www.zora.uzh.ch

Year: 2009

An economic analysis of payment for health care services: the United States and Switzerland compared

Zweifel, Peter ; Tai-Seale, Ming

Abstract: This article seeks to assess whether physician payment reforms in the United States and Switzerland were likely to attain their objectives. We first introduce basic contract theory, with the organizing principle being the degree of information asymmetry between the patient and the health care provider. Depending on the degree of information asymmetry, different forms of payment induce "appropriate" behavior. These theoretical results are then pitted against the RBRVS of the United States to find that a number of its aspects are not optimal. We then turn to Switzerland's Tarmed and find that it fails to conform with the prescriptions of economic contract theory as well. The article closes with a review of possible reforms that could do away with uniform fee schedules to improve the performance of the health care system.

DOI: https://doi.org/10.1007/s10754-009-9061-7

Posted at the Zurich Open Repository and Archive, University of Zurich
ZORA URL: https://doi.org/10.5167/uzh-23706
Journal Article
Published Version

Originally published at:
Zweifel, Peter; Tai-Seale, Ming (2009). An economic analysis of payment for health care services: the United States and Switzerland compared. International Journal of Health Care Finance and Economics, 9(2):197-210.
DOI: https://doi.org/10.1007/s10754-009-9061-7

Int J Health Care Finance Econ (2009) 9:197–210
DOI 10.1007/s10754-009-9061-7

An economic analysis of payment for health care services: The United States and Switzerland compared

Peter Zweifel · Ming Tai-Seale

Received: 6 March 2009 / Accepted: 21 March 2009 / Published online: 9 April 2009
© Springer Science+Business Media, LLC 2009

Abstract This article seeks to assess whether physician payment reforms in the United States and Switzerland were likely to attain their objectives. We first introduce basic contract theory, with the organizing principle being the degree of information asymmetry between the patient and the health care provider. Depending on the degree of information asymmetry, different forms of payment induce "appropriate" behavior. These theoretical results are then pitted against the RBRVS of the United States to find that a number of its aspects are not optimal. We then turn to Switzerland's Tarmed and find that it fails to conform with the prescriptions of economic contract theory as well. The article closes with a review of possible reforms that could do away with uniform fee schedules to improve the performance of the health care system.

Keywords Principal and agent · Optimal payment · Payment for health services

JEL Classification I18 · J33 · J38

Introduction and motivation

In the United States, physician services are paid using a number of mechanisms, ranging from salary and capitation to fee-for-service and case rates. Since 1992 the nation's largest payer of physician services, Medicare, has been paying physicians according to the Medicare Fee Schedule (MFS), using the Resource-Based Relative Value Schedule (RBRVS) (Hsiao et al. 1988). Blue Cross, Medicaid, and commercial insurance companies or health maintenance organizations (HMOs) that cover people younger than 65 often base their payments on a

P. Zweifel (✉)
Socioeconomic Institute, University of Zurich, Hottingerstr. 10, 8032 Zurich, Switzerland
e-mail: pzweifel@soi.uzh.ch

M. Tai-Seale
Texas A&M University, 1266 TAMU, College Station, TX 77845, USA
e-mail: mtaiseale@srph.tamhsc.edu

modified version of the Medicare RBRVS or use the Medicare payment level as a benchmark (Getzen 2007). The RBRVS is a list of physician services in which Relative Value Units (RVUs) are assigned to each service. The RVUs are based on physicians' self-reporting of the time and effort involved in patient care (Hsiao et al. 1988). In addition, payment under RBRVS accounts for the amortized cost of specialty training, geographic variations in input costs, and malpractice insurance costs.

Despite the remarkable effort that went into measuring physician work by the developers of the RBRVS (Hsiao et al. 1988), it remains a challenge to pay for actual effort as opposed to effort reported by the agent (Tai-Seale et al. 2007). This is because many agents may guilefully pursue profit when the opportunity arises (Robinson 2001). Physician agents conduct a variety of tasks, some of which are easily monitored and some of which are not. Monitoring agent effort, though costly, is necessary when incomplete or inaccurate information is self-reported. But attempts to link payment to performance may lead the agent to overinvest time in those tasks that are explicitly measured and rewarded, with a concomitant underinvestment of time elsewhere (Holmström and Milgrom 1991). It is difficult to design payment mechanisms that motivate appropriate effort across multiple tasks for evaluation and management services for multiple chronic diseases typically provided by primary care physicians (Eggleston 2005).

Evidence on the comparative effectiveness of specialists versus generalists—which could be used to support paying one more than the other—is scarce and inconsistent when available. For example, a study of patients with lower back pain treated by primary care physicians, chiropractors, and orthopedic surgeons, found that the outcomes (functional recovery, return to work, complete recovery from lower back pain) were similar across the practitioner types (Carey et al. 1995). A study of patients with HIV in Switzerland showed that the indicators for quality of care were similar across all patient groups, whether treated by generalists or specialists (Page et al. 2003). But several studies have found that primary care physicians are not as up to date on current scientific findings regarding specific treatments and medications (Ayanian et al. 1994; Chin et al. 1997; Harrold et al. 1999).

A Swiss reform of physician payment has raised issues similar to those faced in the United States. The new law on health insurance (LHI94) took effect on January 1, 1996, after barely surviving the test of a popular referendum. LHI94 is the result of a prolonged debate over health policy. On one hand, it facilitates competition between social health insurers, notably by permitting them to write conventional policies with both deductibles in excess of the legal minimum and bonus options for no claims, as well as managed care variants. On the other hand, LHI94 reinforces public planning in the health care sector by mandating cantons (member states) to draw up hospital lists. Social health insurers must only negotiate with hospitals on the list of the respective canton. In addition, LHI94 gives the confederation authority to create and implement nationwide fee schedules for physicians and hospitals.

One such nationwide fee schedule, titled Tarmed, was established over ambulatory medical services in 2000. At first sight, it is unclear whether this fee schedule is a planning tool or an instrument securing competition. Its promoters argue that it creates transparency in the market for health care services, thus encouraging price competition. On the other hand, the nationwide uniformity of Tarmed precludes insurers from negotiating appropriate forms of payment that may well differ across patient and service provider types.

Prior to LHI94, cantonal health insurer associations negotiated with cantonal medical associations over fee schedules. These schedules seldom varied, adjustments usually being limited to the basic value point without adjusting relative prices. This state of affairs was criticized for three main reasons: (1) the negotiations were devoid of cost and efficiency considerations; (2) across the 26 different cantonal schedules, transparency was nonexistent and difficult to envision; and (3) technical procedures were paid too generously compared with more time-intensive services.

With these arguments in the background, the negotiating partners (the federal association of Swiss health insurers [SantéSuisse] and the federal medical association [FMH]) pursued the following objectives: (1) creating transparency through a nationally uniform fee schedule, (2) streamlining future negotiations by introducing principles of business administration, and (3) maintaining cost neutrality during the transition to Tarmed.

Quite likely, similar objectives were pursued with the introduction of the RBRVS in the United States. This article seeks to assess whether the two reforms were ever likely to attain their objectives. We first introduce basic contract theory, with the organizing principle being the degree of information asymmetry between the patient and the health care provider. Depending on the degree of asymmetry, different forms of payment induce "appropriate" behavior. These theoretical results are then pitted against the RBRVS of the United States to find that a number of its aspects are not optimal. We then turn to Switzerland's Tarmed and find that it fails to conform with the prescriptions of economic contract theory. The article closes with a review of possible reforms that could do away with uniform fee schedules to improve the performance of the health care system.

Optimal fee schedules for health care services

In this section, we distinguish three levels of information symmetry: (1) absence of information asymmetry, (2) asymmetric information given concerning the effort of the health care provider to the detriment of the patient, and (3) asymmetric information reported on both the effort and type of health care provider. For each, the properties of an optimal payment system are stated and interpreted.

Optimal payment with symmetric information

In the case of complete information, and assuming competitive markets, it is optimal for the purchaser to pay according to productivity:

$$\frac{p_1}{p_2} = \frac{\partial H/\partial M_1}{\partial H/\partial M_2} \tag{1}$$

This is the well-known requirement of optimum production; relative factor prices must reflect relative (marginal) productivities (which in turn depend on input quantities). In the present case, prices (p_1, p_2) are the fees for health services, the inputs (M_1 and M_2) are medical services, and the resulting output is health status (H).

Optimal payment with asymmetric information on effort

Here, the potential patient is considered the principal, who cannot observe the agent's true effort; the agent is defined as the health services provider (a physician, say). Both principal and agent are assumed to be risk averse. The principal has the objective of maximizing expected utility; he or she cannot maximize utility proper because the health outcome of the agent's effort is uncertain (after all, even maximum effort cannot always avert death). The health outcome is valued in money units (we might note that willingness-to-pay studies are becoming increasingly popular—see, for example, Telser and Zweifel 2002; Ryan and Gerard 2003). The principal's net position is given by the outcome achieved, minus payment to the health care provider. The provider in turn seeks to maximize his or her income, after deduction made for the cost of effort, which may be mainly psychological but is also assumed to be measurable in money units (again, willingness-to-pay studies make this assumption acceptable). If certain regularity conditions hold (see Holmström 1979; Zweifel et al. 2009, Chap. 8), the optimal payment function under these conditions is of the form

$$\frac{u'^{P}[\theta - p^{*}(\theta)]}{u'^{A}[p^{*}(\theta)]} = \lambda + \mu \cdot \frac{\frac{\partial f(\theta|e^{*})}{\partial e}}{f(\theta|e)} = \lambda + \mu \cdot S, \quad \text{with } S := \frac{\frac{\partial(\theta|e^{*})}{\partial e}}{f(\theta|e)} \tag{2}$$

As is often true in economics, optimality requires that a subjective quantity be equal to an objective one. Here, the subjective quantity is a ratio of marginal utilities on the left-hand side of Eq. 2. The numerator is the patient's marginal utility of additional net wealth, $u'^{P}[\theta - p^{*}(\theta)]$, with net wealth defined as the money value of the health outcome, θ, minus (optimal) payment to the provider, $p^{*}(\theta)$. This marginal utility decreases under risk aversion. Therefore, the marginal utility of the patient is high if he or she has low wealth; that is, if the net wealth, or net benefit $\theta - p^{*}(\theta)$ from the transaction with the physician is small. Here, $p^{*}(\theta)$ is the optimal payment function to be determined.

In the denominator on the left-hand side, the service provider's marginal utility, $u'^{A}[p(\theta^{*})]$, appears; it depends on the payment, $p^{*}(\theta)$. If the provider gets the lion's share of the benefit, θ, his or her marginal utility is small. In all, the left-hand side of Eq. 2 attains a high value if most of the benefits of the patient–physician transaction go to the physician, not the patient. Conversely, it attains a low value if the patient, as the principal, retains the most benefits.

Turning to the right-hand side of Eq. 2, there are two components. The first is a fixed quantity, λ. This parameter reflects the so-called participation constraint, meaning that the principal must pay enough under all circumstances to induce the health care provider to sign the contract. It can be shown that λ has a high value if the health outcome (in financial terms) depends on the contract being concluded. The second component consists of two multiplicative factors. The first factor, μ, reflects the so-called incentive compatibility constraint. The contract to be signed must be compatible with the incentives of the agent (the health care provider in the present case), who cannot be prevented from pursuing his or her own goals since the principal (the patient) is unable to observe true effort. The multiplier, μ, has a high value if any deviation from optimal effort would have an important impact on the health outcome for the patient. For example, μ is high in the case of a surgeon, whose failure to exert sufficient effort could be lethal to the patient.

The second factor of the second component of payment (S) could be called the relative stochastic effectiveness of the health care provider. Again, a high S value calls for paying the agent generously. Intuitively, this makes sense because incentives matter most if additional agent effort has great potential impact. Figure 1 illustrates the concept of (relative) stochastic effectiveness.

Two density distributions in Fig. 1 show the likelihood of a less favorable versus a more favorable health outcome. If physician effort is low (e_L), the density distribution $f(\theta|e_L)$ obtains, with much probability mass concentrated on unfavorable outcomes θ_L. If, however, the effort level is high (e_L), the distribution shifts to the right, indicating that favorable outcomes are more likely. If the amount of shifting is marked, stochastic effectiveness, F, is high. It is defined in relative terms, the benchmark being the density distribution, $f(\theta|e^{*})$, that obtains if effort e is at its optimal level e^{*} (as seen by the agent). Thus, F answers the question, How much more likely is a favorable outcome if the physician were to step up his or her unobserved effort?

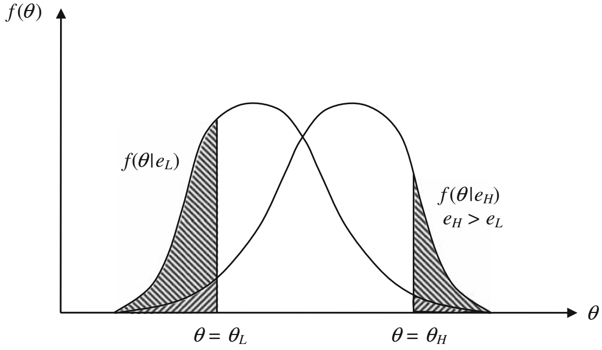

Fig. 1 Health outcomes as a stochastic quantity

Clearly, a physician with high stochastic effectiveness should optimally be paid well (conditional on a favorable outcome). In the interest of the potential patient, health care providers should be paid a bonus if their interventions prove successful. This would serve to induce sufficient effort.

Optimal payment, given asymmetric information on both effort and type

This situation is the most difficult from the point of view of the principal, that is, the (potential) patient. In this case, the principal not only lacks information on the agent's true effort but also on the agent's type. In this context, type is associated with productivity (which in this context can also be interpreted as the level of quality that a provider can attain for a given level of effort). For example, a productive physician may apply relatively little effort to generate a favorable outcome. The problem now becomes that the payment scheme must be such that a productive physician signs the contract.

Because of this complication, the formulation of the optimal payment scheme becomes much more involved, depending on additional parameters. In order to make the analysis tractable, risk neutrality is assumed on the part of both the principal and the provider, which is of course a strong assumption (Laffont and Tirole 1993, ch. 1.4). However, both continue to be interested in the (net) financial value of the outcome of the transaction. Therefore, the principal would like to see cost c as low as possible, whereas the service provider would like to minimize the cost of effort, which is denoted as $\psi(e)$. Thanks to these simplifications, optimal payment has the structure

$$p(\ddot{\beta}, c) = p^*(\ddot{\beta}) - \left[\underbrace{1 - \frac{\kappa}{1+\kappa} \cdot \psi \cdot \frac{F[\beta]}{f[\beta]}[e^*(\ddot{\beta})]}_{N}\right][c - c^*[\ddot{\beta}]] \tag{3}$$

(For a still more refined alternative involving unobserved quality, see, for example, Holmström and Milgrom 1991). On the left-hand side of Eq. 3, one has the optimal payment function given that the agent is of announced type $\ddot{\beta}$ (which generally differs from true type β). An important property of the function is the extent to which the cost c incurred—which is assumed to be observable—is taken into account.

The right-hand side of Eq. 3 again consists of two components. The first is the optimal payment function $p^*(\ddot{\beta})$, which would hold if signalled type $\ddot{\beta}$ were the true one, β. For payment to be truly optimal, it should induce the agent to tell the truth, that is, ensuring

$\ddot{\beta} = \beta$ (the so-called revelation principle). However, the point of departure is $\ddot{\beta} \neq \beta$, which causes the optimal function $p^*(\ddot{\beta}, c)$ on the right-hand side and must still induce truth-telling to differ from the benchmark $p^*(\beta, c)$ on the left-hand side, in which truth-telling is already assured.

The second component on the right-hand side of Eq. 3 amounts to a (complicated) correction factor. Two quantities interact multiplicatively. Starting with the second, $[c - c^*[\ddot{\beta}]]$ symbolizes a deviation of actual cost c from the benchmark value c^* that would obtain if a provider of type $\ddot{\beta}$ exerts optimal effort. In case the health care provider shows a cost overrun, $c > c^*[\ddot{\beta}]$, the issue becomes whether he or she should be fully charged for it. Conversely, actual cost c may be below the optimal level given by $c^*[\ddot{\beta}]$. Here, the question is whether the provider should be fully credited for this saving. This would mean that the first quantity, N, is equal to 1.

The factor N is generally less than 1, however, implying that cost overruns are not fully charged (and cost savings not fully credited) to health care providers. The reason for this weakening of incentives is $\psi'' > 0$, which signifies the rate of increase of the marginal psychic cost with an increase in effort e. Thus, the cost of effort is assumed to increase progressively. Service providers differ in regard to the progression of their cost of effort. Some may be quite productive, causing the rate of increase to be low (ψ'' low). Other providers may be less productive, possibly also less motivated (ψ'' high). These differences are to be evaluated at the effort level, e^*, that the service provider considers to be his or her optimum, which in turn depends on type, β.

Finally, the deduction from the maximum value of 1 for the multiplier N depends on two parameters. The first is κ, the rate of inefficiency associated with raising revenue. In the case of tax finance (for a national health service), κ is around 0.25; that is, an efficiency loss of 25 cents accompanies every additional dollar raised (Ballard et al. 1985; Campbell and Bond 1997). In the case of health insurance, κ corresponds to the loading (that is, the charges in excess of the expected value of benefits paid) for administrative expense, user cost of capital invested, and accumulation of reserves. Here, κ also amounts to about 25% of every dollar raised. Finally, the ratio $F[\beta]/f[\beta]$ between the cumulative distribution up to type β and the density of type β, indicates the degree that incentives are targeted. If this ratio has a high value, then incentives targeted at type β affect many other, less productive types. In this situation, it makes sense for the factor N to be small, making payment less geared toward deviations from planned cost.

In all, the factor N optimally has a value between 0 and 1, which implies that (1) cost overruns should not be fully charged to health care providers and (2) any underspending should not be fully credited to them either. This is intuitive because on the one hand, full charging would discourage effort too much in view of the increasing marginal cost of effort; on the other hand, full crediting would attract less productive providers, although they have a strongly increasing marginal cost of effort (which jacks up benchmark cost $c^*[\ddot{\beta}]$). These considerations gain in importance when inefficiency κ is large—$\kappa/(1+\kappa)$ increases in κ—and when the contract is offered to a population of health care providers that is rather diffuse in terms of productivity.

Conclusion 1: The optimal form of payment for health care services—from the patient's point of view—depends on the extent that information is asymmetric. If the marginal productivities of service providers, in terms of health, can be observed by the potential patient, fees should be in accordance with them; if provider effort cannot be observed, payment should optimally contain a fixed amount and a surcharge/reduction for especially favorable/unfavorable outcomes; and, finally, if neither effort nor type of provider can be observed, cost overruns/savings should only partially be sanctioned/honored.

Does the U.S. system satisfy optimality conditions?

According to the Physician Payment Review Committee (PPRC), created by the U.S. Congress for the purpose of reforming physician payment, the goals of the RBRVS are to base physician payment on resource costs, separate from the old system of "customary, prevailing and reasonable" charges (Hsiao et al. 1988). The PPRC gave this explanation for its decision to recommend the development of a relative value scale on resource costs: "A resource cost basis would reflect estimates of what relative values would be under a hypothetical market that functions perfectly. Under such a market, competition drives relative prices to reflect the relative costs of efficient producers" (PPRC 1988). The determinants of physician payment under the RBRVS consist of (1) the actual physician time consumed by the service or procedure; (2) the intensity of the work, including mental effort, judgment, technical skills, physical effort, and stress; (3) the amortized cost of specialty training; and (4) the overhead cost of the practice, including professional liability insurance premiums. These four determinants are compared with Eqs. 1–3, according to the three types of information distinguished.

Does the RBRVS satisfy optimality conditions given perfect information?

1. *Physician time.* Linking payment more closely to work time has little to do with marginal productivities $\partial H/\partial M$.
2. *Intensity of work.* This addresses input M but not with marginal productivity $\partial H/\partial M$.
3. *Amortized cost of specialty training.* While payment according to specialty training could reflect marginal differences in productivity, $\partial H/\partial M$ in Eq. 1, evidence on the marginal contribution to health of specialists versus general practitioners is rather scarce.
4. *Overhead cost of practice.* One could argue that high infrastructure expenses correspond to high marginal productivity. However, there is the counterargument that paying for infrastructure amounts to reimbursing inputs that are not related to physician activity. It can be shown that this may create incentives for overtreatment, resulting in a deterioration of patient health (see Zweifel et al. 2009, ch. 9.4.2.3).

Does the RBRVS satisfy optimality conditions in the case of asymmetric information on effort?

We examine the four determinants of physician payment under the RBRVS when information on agent effort is asymmetric:

1. *Physician time*. This could possibly ensure incentive compatibility in the choice of effort (μ) in Eq. 2. It does not take into account health outcome θ.
2. *Intensity of work.* This could also possibly ensure incentive compatibility in the choice of effort (μ) in Eq. 2. Likewise, it overlooks health outcome θ.
3. *Amortized cost of specialty training.* This is clearly designed to induce specialists to sign the contract—the participation constraint (λ) in Eq. 2. It is less clear whether paying the amortized cost of specialty training will create sufficient financial incentives for providers to put forth effort on behalf of patients—the incentive compatibility constraint (μ). There is also no clear evidence that the outcome $\theta$is more favorable for patients served by specialists versus primary care providers, given similar conditions. Similarly, it is uncertain

Table 1 Properties of the RVRBS

Dimension of payment	Perfect information [Eq. 1]			Asymmetric information concerning effort [Eq. 2]			Asymmetric information concerning effort and type of provider [Eq. 3]	
	$\frac{(\partial H)/(\partial M_1)}{(\partial H)/(\partial M_2)}$	λ	μ	S	ψ	κ	F/f	ψ''
Physician time	*	0	*	0	0	0	0	*
Intensity of work	*	0	*	0	*	0	0	0
Amortized cost of specialty training	*	✓	*	✓	0	0	*	0
Overhead cost of practice	–	✓	0	0	0	0	0	0

Note: * = addresses somewhat; 0 = does not address; – = counterproductive effect; ✓ = addresses

whether specialists would provide more optimal effort (e). Therefore, it is unclear whether paying a premium price for specialists would engender superior stochastic effectiveness (S) in Eq. 2.

4. *Overhead cost of practice.* Payment for this satisfies the participation constraint (λ) in Eq. 2 without having other incentive effects.

Does the RBRVS satisfy optimality conditions when information on effort and type is asymmetric?

1. *Physician time.* The length of the time interval that can be billed does not have any recognizable relationship with the parameters of Eq. 3.
2. *Intensity of work.* This serves to reimburse the cost of effort, possibly also the rate with which the marginal cost of effort increases, ψ'' in Eq. 3.
3. *Amortized cost of specialty training.* This parameter seems to reflect the so-called informational rent. It is an extra payment that must be offered to the most productive provider (who cannot be recognized as such), possibly also the ratio $F[\ddot{\beta}]/f[\ddot{\beta}]$ in Eq. 3.
4. *Overhead cost of practice.* This might at best reflect informational rent to the extent that an especially productive provider might also invest heavily in the infrastructure of his or her practice.

When reading Table 1 horizontally, one sees that the RBRVS does not have a clear relationship with the theoretically indicated parameters even in the case of perfect information, as shown in Eq. 1. Overhead costs might even have counterproductive effects. In the case of asymmetric information on effort, the RBRVS pays the participation constraint (λ) several times, but the incentive compatibility constraint (μ) only marginally. By way of contrast, stochastic effectiveness (S) is reflected only once through paying for the amortized cost of specialty training.

Given that asymmetric information is given on both effort and type, the RBRVS at best reflects the cost of effort ψ. The degree that incentives are targeted ($F[\ddot{\beta}]/f[\ddot{\beta}]$) is honored once (through paying for amortized cost of specialty training). The increase of marginal cost of effort (ψ'') is reflected by actual physician time with patients. Finally, the efficiency losses associated with health insurance (κ) are not accounted for at all.

Conclusion 2: The RBRVS best accounts for the participation constraint in the case of asymmetric information on provider effort; with regard to all other parameters relevant in the light of the economic theory, there are no clear relationships, especially in the case of asymmetric information on provider type.

Does Switzerland's Tarmed schedule satisfy optimality conditions?

When comparing Tarmed with the requirements derived from economic theory, it is useful to review the determinants of physician payments under Tarmed. The following six determinants are distinguished (Eidgenössisches Volkswirtschaftsdepartement 1999):

1. *Dignity.* Reflects the amount of a physician's specialist training.
2. *Reference income.* Amount a physician with a well-run practice must pay for a replacement (for example, during a vacation).
3. *Annual work time.* Used for calculating an implicit wage rate. The norm is 1,920 h of work annually, although one survey yielded 1,970 h. Therefore, the implicit wage rate of a physician is set too high from the beginning.
4. *Billable time.* Refers to time spent with patients as a percentage of total annual work time. Initially, this was fixed at 85% of total work time, to be staggered according to *Dignity* (criterion no. 1), resulting in an average share of 81.7%. This adjustment again serves to increase the implicit wage rate.
5. *Actually billed work time.* Whereas earlier schemes used to take into account 15-min intervals only, now 5-minute intervals may be used, resulting in a tighter relationship between time worked and amount billed.
6. *Infrastructure of the practice*. The entire infrastructure, including wages paid to nonmedical employees, is to be financed by Tarmed payment.

These six determinants are now pitted against Eqs. 1–3, according to the three degrees of distinguished asymmetric information.

Table 2 Properties of Tarmed

Dimension of payment	Perfect information [Eq. 1]	Asymmetric information concerning effort [Eq. 2]			Asymmetric information concerning effort and type of provider [Eq. 3]			
	$\frac{(\partial H)/(\partial M_1)}{(\partial H)/(\partial M_2)}$	λ	μ	S	ψ	κ	F/f	ψ''
Dignity (1)	*	✓	*	✓	0	0	*	0
Reference income (employed physician) (2)	0	✓	0	0	0	0	0	0
Annual work time (3)	*	0	*	0	✓	0	0	0
Billable work time (4)	*	0	*	0	✓	0	0	*
Actually billed work time (5)	0	0	0	0	0	0	0	0
Infrastructure of practice (6)	–	✓	0	0	0	0	0	0

Note: * = addresses somewhat; 0 = does not address; – = counterproductive effect; ✓ = addresses

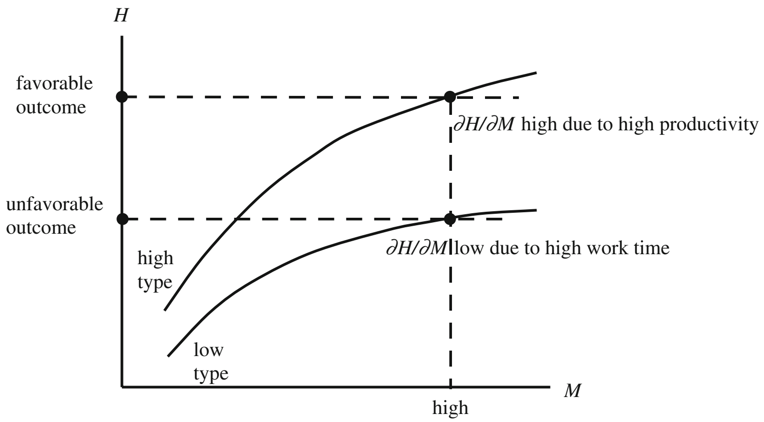

Fig. 2 Marginal productivity in terms of health, ∂H/∂M

Does Tarmed satisfy optimality conditions given symmetric information?

1. *Dignity.* As mentioned above, while payment according to specialty training could reflect marginal differences in productivity, $\partial H/\partial M$ in Eq. 1, evidence on the marginal contribution to health by specialists compared to that of general practitioners is scarce. Moreover, improvements in effectiveness through training should be written off over time, a consideration not taken into account by Tarmed (see Table 2).
2. *Reference income.* The annual income of an employed physician working as a substitute of an independent doctor does not have any relationship with $\partial H/\partial M$, the marginal productivity of physician services in terms of health of patients.
3. *Annual work time.* High annual work time is an ambiguous indicator of $\partial H/\partial M$. On the one hand, it could reflect the especially high marginal productivity of the provider (see "high type," Fig. 2). On the other hand, it could point to decreasing marginal returns to labor input (see "low type," Fig. 2).
4. *Billable work time.* Additional time spent on a service usually is subject to decreasing marginal returns. But Tarmed does not apply any degression to fees as a function of time worked.
5. *Actually billed work time.* Linking payment more closely to work time has nothing to do with marginal productivity $\partial H/\partial M$.
6. *Infrastructure of the practice.* As mentioned before, paying for infrastructure could amount to reimbursing inputs that are not related to physician activity. It can be shown that this may create incentives for overtreatment, resulting in a deterioration of patient health (see Zweifel et al. 2009, ch. 9.4.2.3).

Does Tarmed satisfy optimality conditions when information on effort is asymmetric?

Once more, the six determinants of payment are checked (see Table 2):

1. *Dignity.* This is clearly designed to make specialized health care providers sign the contract, participation constraint (λ) in Eq. 2. It is far less clear whether dignity serves to create incentives for providers to exert effort on behalf of patients, incentive compatibility

constraint (μ). It may be assumed, however, that providers with high dignity have high stochastic effectiveness (S).

2. *Reference income.* This likely only serves to satisfy the participation constraint (λ).
3. *Annual work time.* This could possibly ensure incentive compatibility in the choice of effort (μ) in Eq. 2.
4. *Billable work time with patients.* This is another feature that may serve to satisfy the incentive compatibility constraint (μ); however, it cannot be related to the other parameters (λ, S) of the optimal payment function.
5. *Actually billed work time.* There does not seem to be any relationship between the length of time intervals billed and any of the three parameters (λ, μ, S).
6. *Infrastructure of the practice.* Payment for this once more serves to satisfy the participation constraint (λ) in Eq. 2 without having other incentive effects.

Does Tarmed satisfy optimality conditions when information on effort and type is asymmetric?

1. *Dignity.* Again, this parameter seems to reflect so-called informational rent. This is an extra payment that must be offered to the most productive provider (who cannot be recognized as such), possibly also the ratio $F[\ddot{\beta}]/f[\ddot{\beta}]$ in Eq. 3.
2. *Reference income.* Here it is difficult to see any relationship to the five parameters appearing in Eq. 3.
3. *Annual work time.* This dimension of payment is definitely related to the cost of effort to be covered (ψ) but not with any of the other five parameters.
4. *Billable work time with patients.* Once more, this serves to reimburse the cost of effort, possibly also the rate with which the marginal cost of effort (ψ'')increases, as shown in Eq. 3.
5. *Billed work time.* The length of the time interval that can be billed does not have any recognizable relationship with the parameters of Eq. 3.
6. *Infrastructure of practice.* This might at best reflect the informational rent (see *Dignity,* above) to the extent that an especially productive provider might also invest heavily in the infrastructure of his or her practice.

When reading Table 2 horizontally, one sees that Tarmed does not have a clear relationship with the theoretically indicated parameters, even in the case of perfect information, as shown in Eq. 1. Indeed, paying for the infrastructure of the practice might even have counterproductive effects. In the case of asymmetric information on effort, Tarmed pays the participation constraint (λ) several times, but the incentive compatibility constraint (μ) only marginally. By way of contrast, stochastic effectiveness (S) is reflected only once, through dignity.

Given that the asymmetric information is on both effort and type, Tarmed at best reflects the cost of effort (ψ). The degree that incentives are targeted ($F[\ddot{\beta}]/f[\ddot{\beta}]$) is honored at least once (through dignity). The increase of marginal cost of effort (ψ'') is reflected by work time with patients. Finally, the efficiency losses associated with health insurance (κ) are never accounted for at all.

Conclusion 3: Tarmed best accounts for the participation constraint in the case of asymmetric information related to provider effort; with regard to all other parameters relevant in the light of the economic theory, there are no clear relationships, especially when asymmetric information is given on provider type.

Concluding remarks

The objectives of this study are (1) to assess the extent to which the RBRVS of the United States and Tarmed, the Swiss fee schedule for ambulatory medical services, accord with their stated objectives, and (2) whether they provide optimal conditions from the point of view of a more or less uninformed potential patient. With regard to the first objective, the much emphasized advantage of making physician fees transparent has been heavily discounted here because it is of little value to (potential) patients. All patients need to know is whether there is an excellent provider of health care services nearby and whether the health insurer has a contract with that particular provider (which is not a problem with physicians who are on the approved provider lists of multiple insurers in the United States, but may be in the case of a hospital that is not on a canton's list in Switzerland). For consumers, transparent medical fees and structures therefore have only minor importance. Rather, transparency seems to be in the interest of political decision makers who seek to control the entire health care sector using a uniform fee schedule. In addition, we found that the RBRVS has achieved far less cost savings than possible, due to the vehement opposition of special interests. Also, since Tarmed is not based on cost principles, health care providers have succeeded in padding fees in several ways. The concomitant increase in their implicit wage rate has made cost neutrality unattainable.

With regard to the second objective, the issue of optimal incentives from the point of view of consumers, neither the RBRVS nor Tarmed satisfies any one of three possible sets of optimality conditions, regardless of whether (1) potential patients have perfect information, (2) they suffer from asymmetric information with regard to provider effort, or (3) they suffer from asymmetric information regarding both effort and type of health care provider.

To conclude, in the United States, the RBRVS has not accomplished its goals to slow down cost escalation and equalize income between procedure-based providers and primary care providers. In the case of Switzerland, no contribution to the efficient provision of health care can be expected from Tarmed. These failures are underlined by the following argument. Health insurers can be considered complementary agents in health care, promising to mitigate very basic weaknesses characterizing the physician-patient relationship (Zweifel et al. 2003). This implies that they should live up to the task of negotiating forms of payment on behalf of their (potential) patients that serve to convey appropriate incentives to health care providers, depending on the types of insured illness and health condition considered.

For example, some patients with chronic diseases may become quite well informed on the risks and benefits of treatment alternatives. For them, fees that reflect marginal productivities of therapies ($\partial H/\partial M$) are an optimal form of payment as shown in Eq. 1. For some acute situations, the effort of the health care provider may be crucial, while his or her type is of less relevance. For instance, even if a gatekeeping general practitioner is not highly productive, what matters is his or her careful diagnosis, which determines the entire treatment path. Here, it would be in the interest of the insured to pay the gatekeeper a bonus for very favorable outcomes (at the end of the treatment episode).

Finally, for a consumer who is prone to accidents calling for surgical intervention, it would be optimal to have a contract that pays fee-for-service in the event of an accident (granting full recovery of cost to the surgeon even if the bill may appear exceedingly high), while for regular diseases payment is provided according to a prenegotiated schedule (which makes the provider bear at least part of the excess cost).

Insurers have empirical data that could be used to inform the type of provider under a patient's consideration whereas patients could provide some information on physician effort that are not observable to insurers. It is an interesting question whether encouraging information exchange between the insurer and patient may alleviate some problems stemming from asymmetric information on effort and type. Information on the comparative effectiveness of specialists versus general practitioners could also be useful in guiding payment reform efforts.

The nationwide uniformity of Tarmed also contradicts the procompetitive philosophy of recent reforms because it undermines insurers' incentive to seek out providers who charge the minimum cost for a given treatment. But it is precisely this effort on the part of insurers that could contribute to an improvement of the benefit-cost ratio in health care, and ultimately, of the economy as a whole.

References

Ayanian, J. Z., Hauptman, P. J., Guadagnoli, E., Antman, E. M., Pashos, C. L., & McNeil, B. J. (1994). Knowledge and practices of generalist and specialist physicians regarding drug therapy for acute myocardial infarction. *The New England Journal of Medicine, 331*(17), 1136–1142. doi:10.1056/NEJM199410273311707.

Ballard, C. L., Shove, J. B., & Whalley, J. (1985). General equilibrium computations of the marginal welfare costs of taxes in the United States. *The American Economic Review, 75*, 128–138.

Campbell, H. F., & Bond, K. A. (1997). The cost of public funds in Australia. *The Economic Record, 73*, 22–24. doi:10.1111/j.1475-4932.1997.tb00976.x.

Carey, T. S., Garrett, J., Jackman, A., McLaughlin, C., Fryer, J., & Smucker, D. R. (1995). The outcomes and costs of care for acute low back pain among patients seen by primary care practitioners, chiropractors, and orthopedic surgeons. *The New England Journal of Medicine, 333*(14), 913–917. doi:10.1056/NEJM199510053331406.

Chin, M., Friedmann, P., Cassel, C., & Lang, R. (1997). Differences in generalist and specialist physicians' knowledge and use of angiotensin-converting enzyme inhibitors for congestive heart failure. *Journal of General Internal Medicine, 12*(9), 523–530.

Eggleston, K. (2005). Multitasking and mixed systems for provider payment. *Journal of Health Economics, 24*(1), 211–223.

Eidgenössisches Volkswirtschaftsdepartement.Preisüberwachung. (1999). Stellungnahme zu den Tarifen GRAT/Infra. Bern: EDMZ (31.3.1999).

Getzen, T. (2007). *Health economics and health financing*. New Jersey: John Wiley and Sons.

Harrold, L. R., Field, T. S., & Gurwitz, J. H. (1999). Knowledge, patterns of care, and outcomes of care for generalists and specialists. *Journal of General Internal Medicine, 14*(8), 499–511. doi:10.1046/j.1525-1497.1999.08168.x.

Holmström, B. (1979). Moral hazard and observability. *The Bell Journal of Economics, 10*(1), 74–91. doi:10.2307/3003320.

Holmström, B., & Milgrom, P. (1991). Multi-task principal agent analysis: Incentive contracts, asset ownership and job design. *Journal of Law Economics and Organization, 7*, 26–52.

Hsiao, W. C., Braun, P., Dunn, D., & Becker, E. R. (1988). Resource-based relative values. An overview. *Journal of the American Medical Association, 260*(16), 2347–2353. doi:10.1001/jama.260.16.2347.

Laffont, J.-J., & Tirole, J. (1993). *A theory of incentives in procurement and regulation*. Cambridge, MA: M.I.T. Press.

Page, J., Weber, R., Somaini, B., Nöstlinger, C., Donath, K., & Jaccard, R. (2003). Quality of generalist vs. specialty care for people with HIV on antiretroviral treatment: a prospective cohort study. *HIV Medicine, 4*(3), 276–286. doi:10.1046/j.1468-1293.2003.00157.x.

Physician Payment Review Commission. (1988). *Annual report to congress*. Washington, DC.

Robinson, J. C. (2001). Theory and practice in the design of physician payment incentives. *The Milbank Quarterly, 79*(2), 149–177. doi:10.1111/1468-0009.00202.

Ryan, M., & Gerard, K. (2003). Using discrete choice experiments to value health care programmes: Current practice and future reflections. *Applied Health Economics and Health Policy, 2*(1), 55–64.

Tai-Seale, M., McGuire, T., & Zhang, W. (2007). Time allocation in primary care office visits. *Health Services Research, 42*(5), 1871–1894. doi:10.1111/j.1475-6773.2006.00689.x.

Telser, H., & Zweifel, P. (2002). Measuring willingness-to-pay for risk reduction: An application of conjoint analysis. *Health Economics, 11*(3), 129–139. IM TEXT: 1999 (Seite 4).

Zweifel, P., Breyer, F., & Kifmann, M. (2009). *Health economics*, 2nd ed. Boston: Springer.
Zweifel, P., Lehmann, Hj., & Steinmann, L. (2003). Patching up the physician-patient relationship. In B. Lindgren (Ed.), *Arne Ryde symposium*. Lund: Lund University Press, pp. 207–233.